Digital Transformation of Last-Mile Delivery

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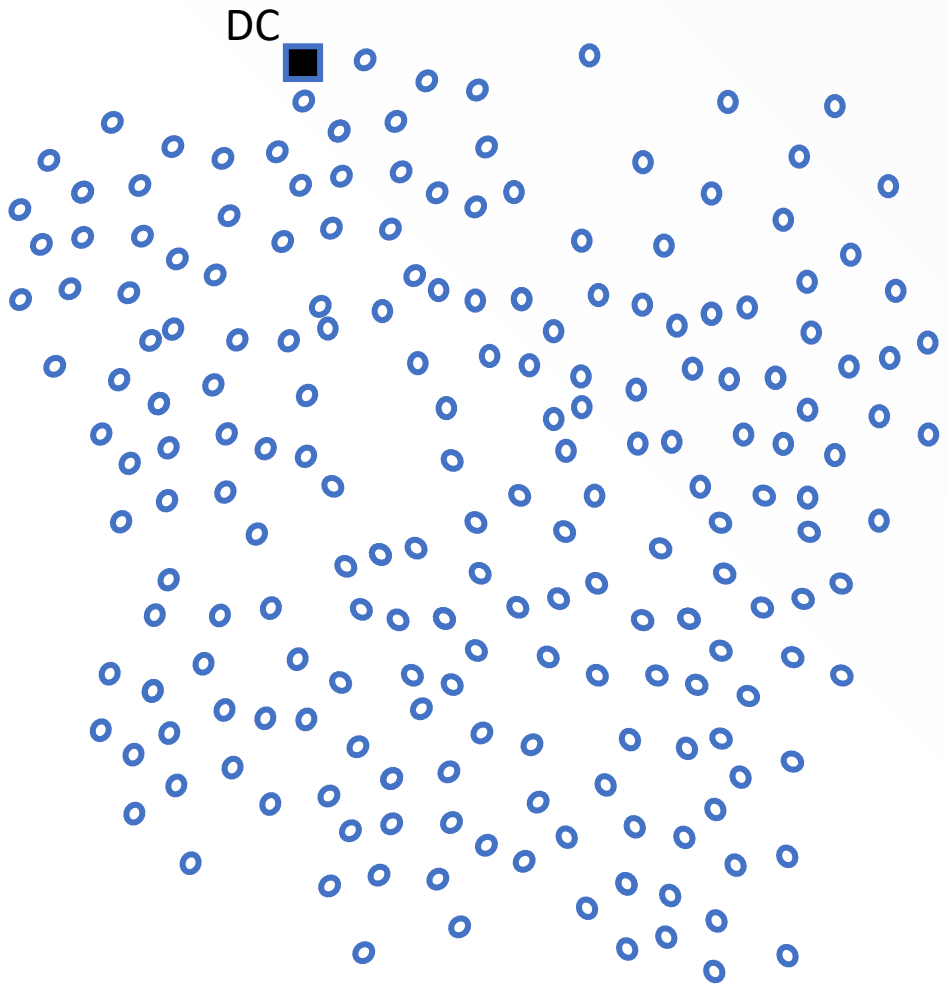
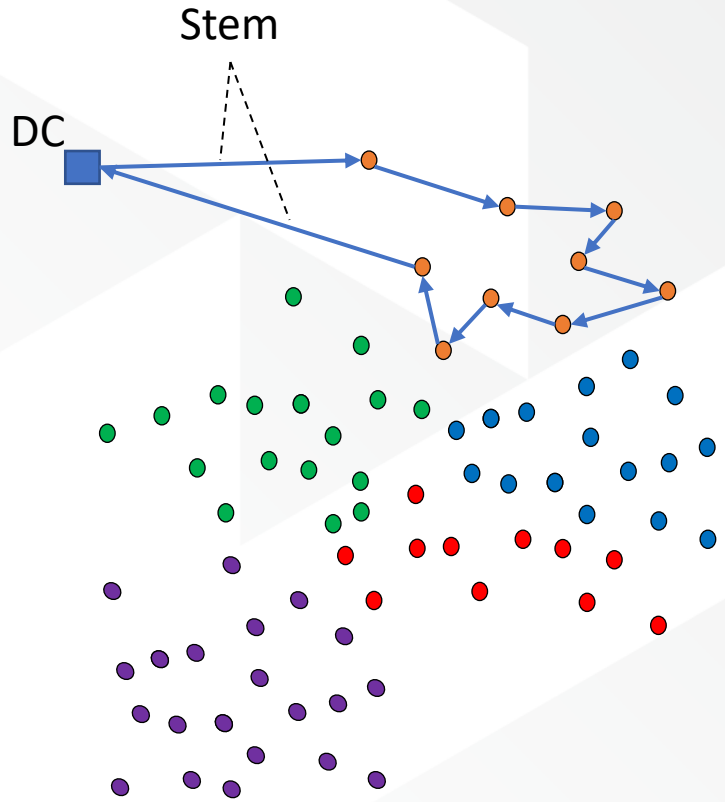
Delivery Dynamics

Delivery Planning



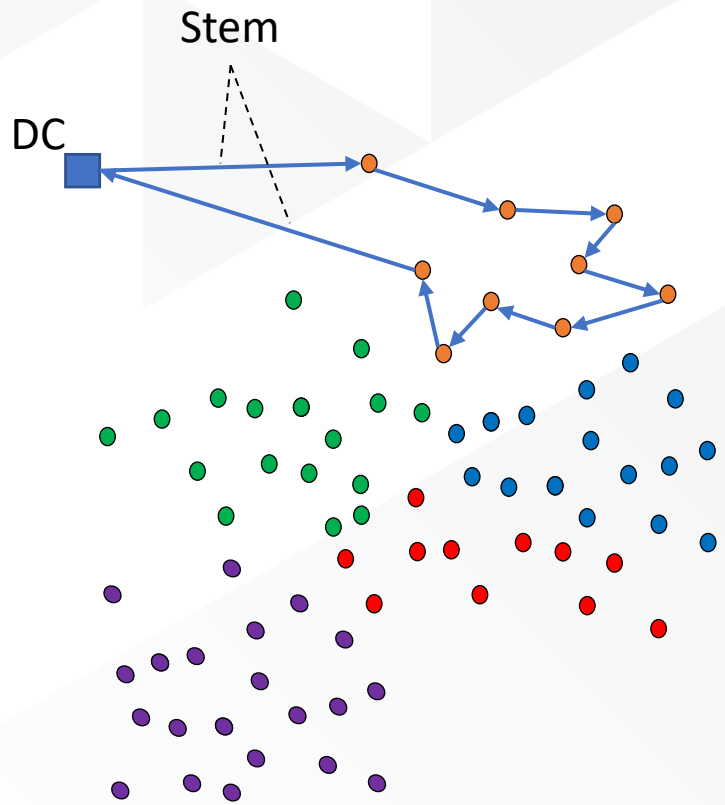


- Each day a subset of customers require deliveries
- The deliveries must be grouped into routes and sequenced in delivery order
- The results must satisfy delivery constraints, be efficient and make customers happy

Delivery Dynamics

Number of Possible Delivery Routes

- Suppose there are **200 customers** that must be visited with **10 trucks**.
- There are (200 to the 10th power)/10! or about **55 trillion possible groupings** of the customers into the **10 routes**.
- There are 20! or about **2,433 trillion possible sequences** for a group with **20 customers**.
- It is **impossible** to generate delivery routes that are **provably optimum**.
- Good route optimizers combine **efficient computer processing** with **optimization concepts** to evaluate very large numbers of good groupings and sequences and select the best possible in the time available.
- The only way to **evaluate** a route optimizer is to **try it**!



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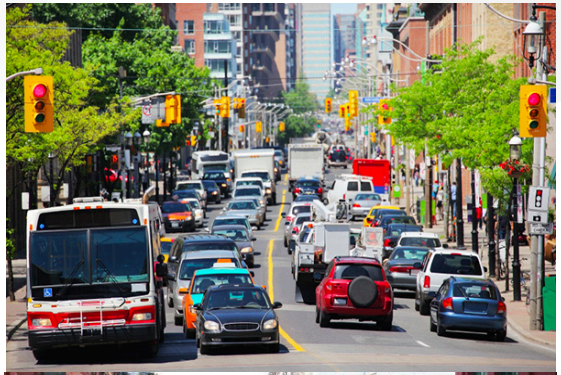
Delivery Environments are continually changing

- Increasing urban deliveries
- Changing traffic patterns
- Decreased parking availability
- Restrictions on road usage by trucks
- Increasing customer expectations
- Decreased time available for planning
- Increasing cost of labor
- Increasing stop time to drive time ratio
- Increasing delivery cost to value ratio
- Multiple customers serviced from the same stop
- Increasing customer-first strategies



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What is wrong with current delivery management?

- Assumes an unrealistically static environment
- Inaccurate and missing data
- Poor time estimates for routes
- Extensive manual effort on daily route plans
- Ad hoc planning processes
- Inefficient or unachievable delivery plans
- “Islands” of technology
- Delivery monitoring doesn’t improve delivery planning
- No digital process improvement

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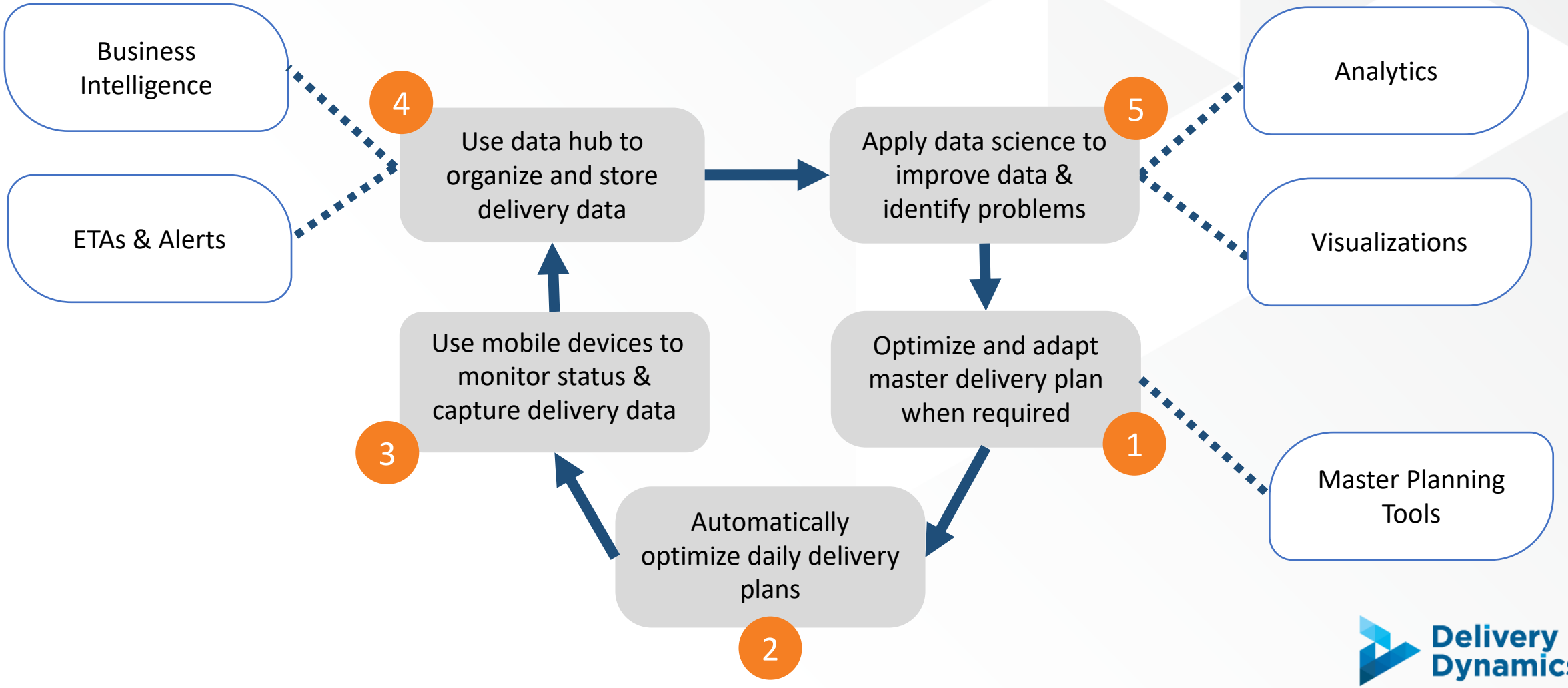
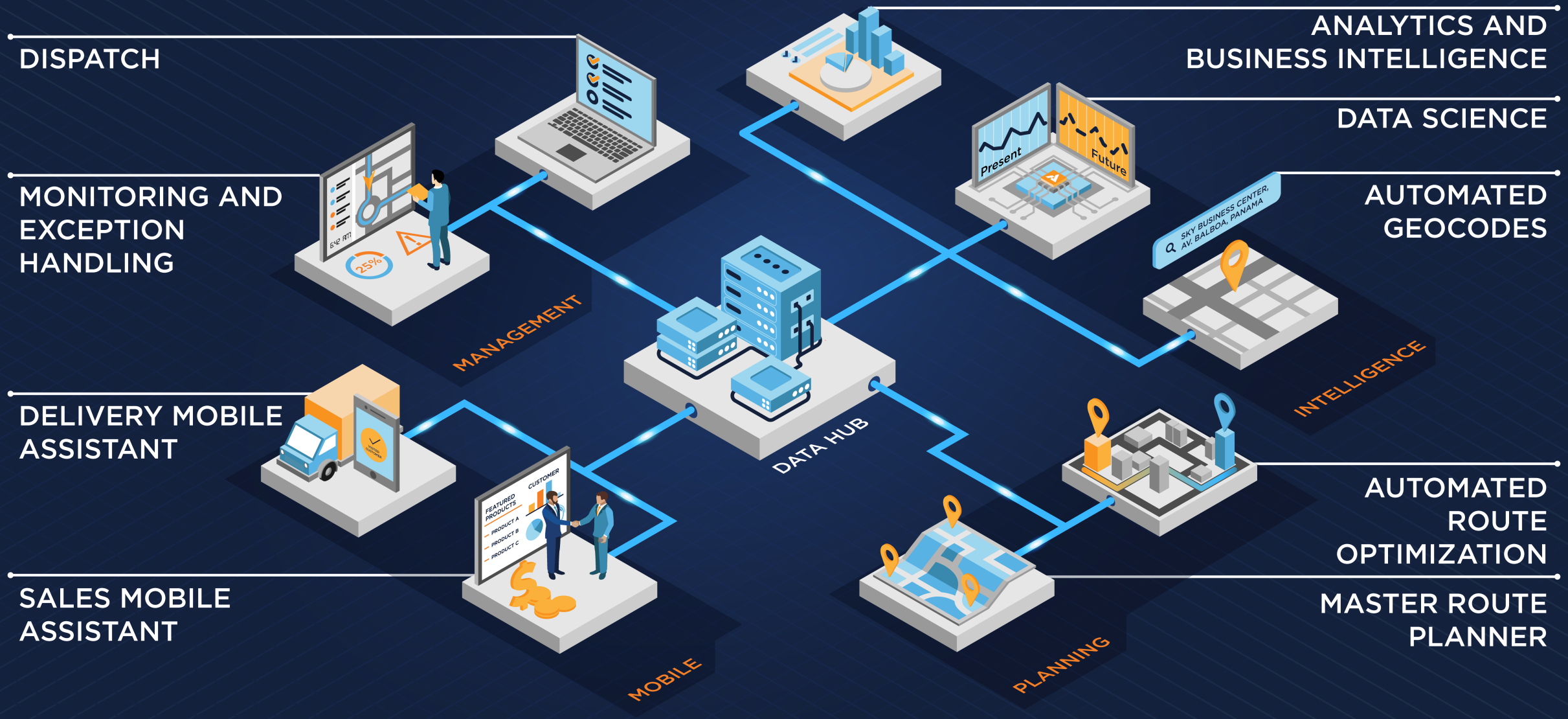
A Better Approach - Adaptive Delivery Management



Delivery Dynamics

Delivery Dynamics Integrated Platform



Design Issues – traditional sales

- Determine delivery day assignments
  - Drivers are typically on salary
  - Trucks are owned or leased
  - Costs are mostly fixed
  - Minimize delivery cost by balancing work over days
- Determine sales rep assignments
  - Delivery frequency is usually based on sales volume
  - For “traditional sales” a sales rep takes orders that are delivered X days later
  - Minimize sales rep cost by balancing work over days
- Determine route strategy
  - Driver familiarity decreases drive time and service time
  - Customers like having the same driver and salesperson each visit
  - Returns and revisits
  - Dynamic or master routes

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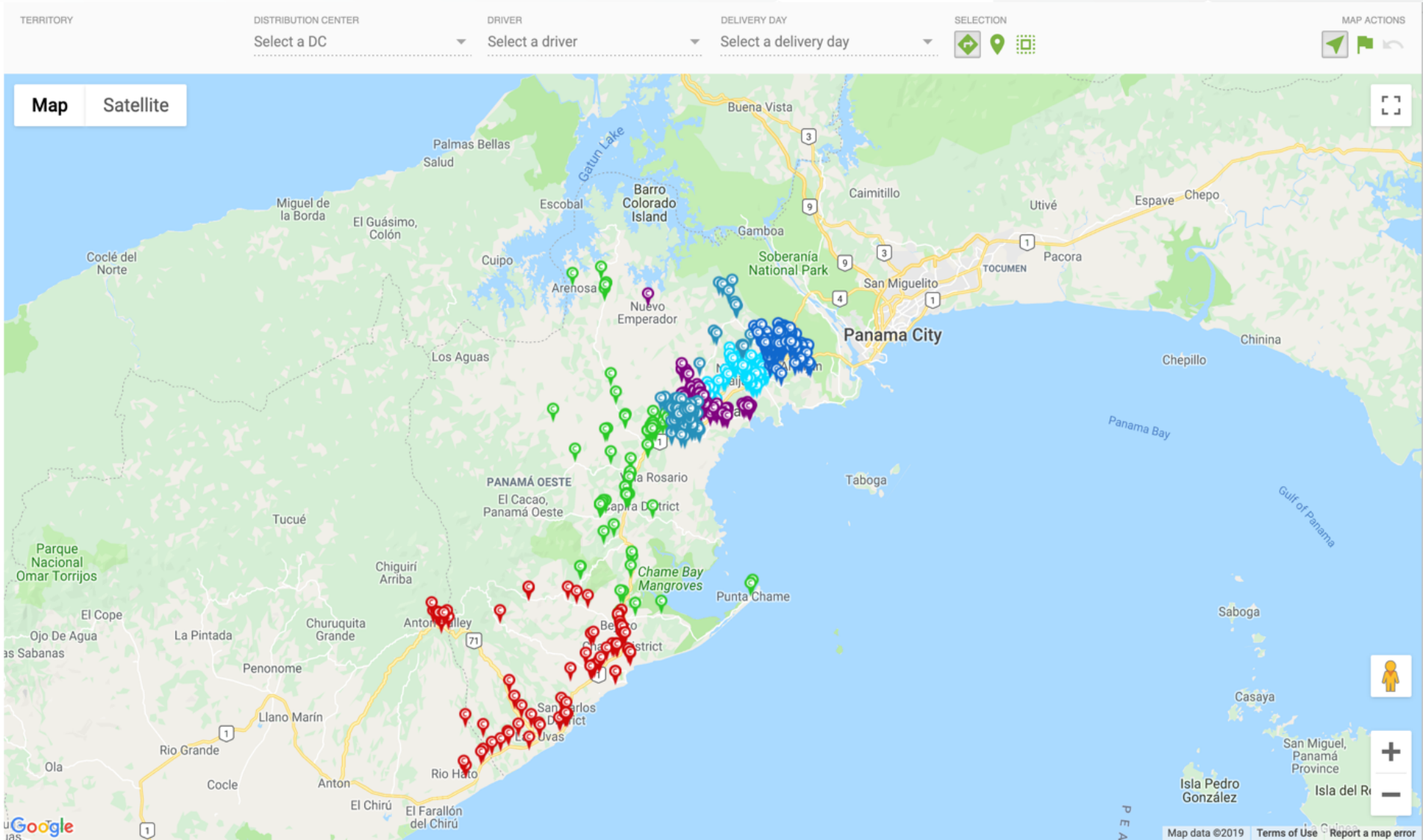
Master Routes & Day Balance

Group routes by: Territory

TABLE ACTIONS

ID	Color	Num Routes	Num Cust.	Route time (h)	Drive time (h)	Stop time (h)
0		1	0			
VIERNES		7	117			
MARTES		8	95			
MIÉRCOLES		8	106			
JUEVES		7	109			
SÁBADO		8	123			
LUNES		7	80			



What data is required?

- Customer data
  - Geocodes
  - Delivery stop times
  - Delivery windows
  - Delivery restrictions
- Drive data
  - Drive times
  - Drive distances
- Order data
  - SKUs
  - Quantities
  - Size
- Product data
  - Weight
    - Volume
- Truck data
  - Size
  - Cost
- Driver data
  - Availability
  - Cost
- Stop data
  - Parking
  - Multiple delivery points

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Stop time data

- Typical approach is to use a general estimating function {e.g., time = (fixed time) + (# line items)*(variable time)}
- Often very large errors in predicted delivery times
- Better approach is to use a different estimating distribution for each customer

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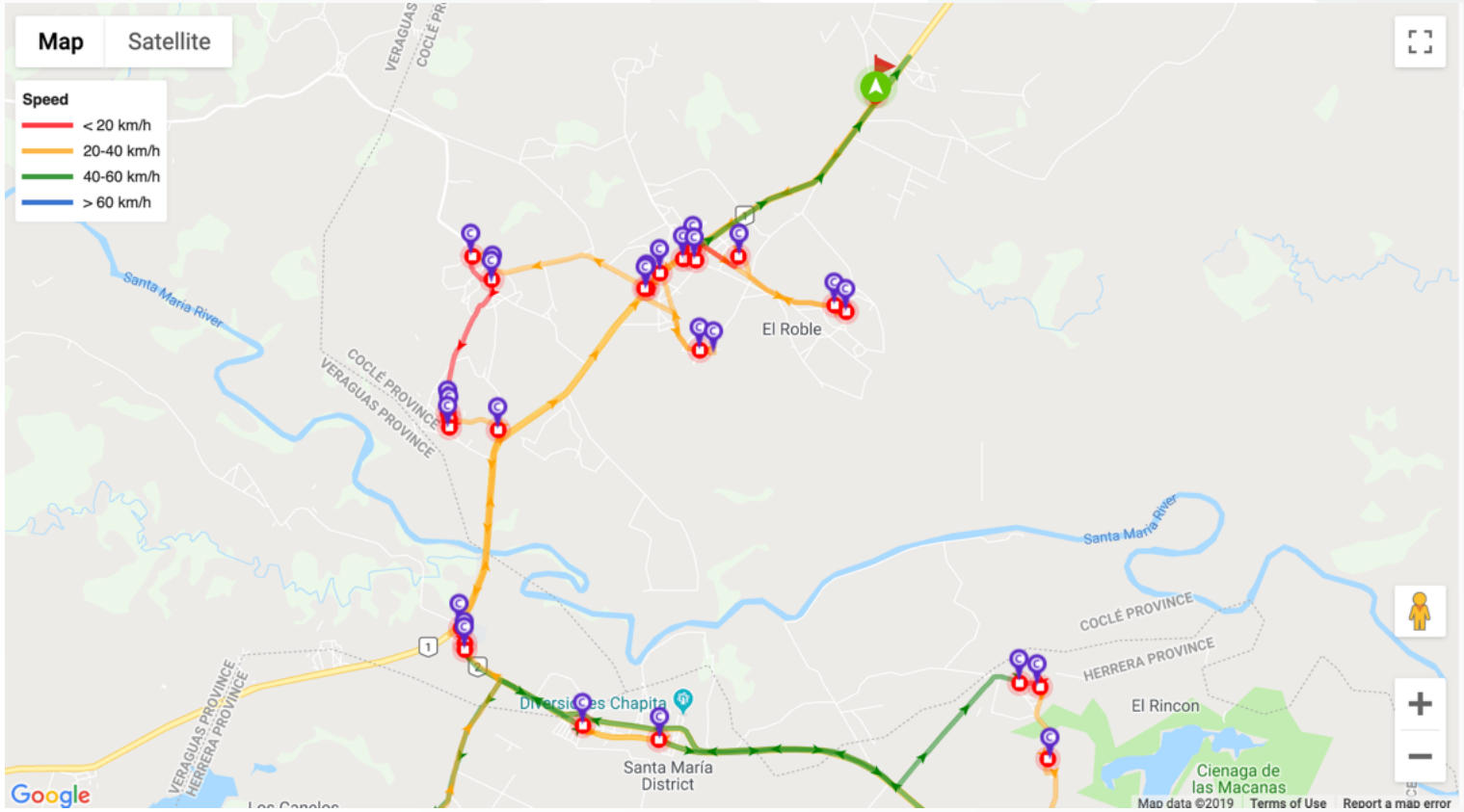
Drive time data

- Data required
  - Drive distance matrix
  - Drive time matrix
- Sources
  - Google
  - Bing
  - Open streets
- Problems
  - Bad geocodes
  - Bad network assignment
  - Drive time variability
- Solution
  - Revise based on GPS trails



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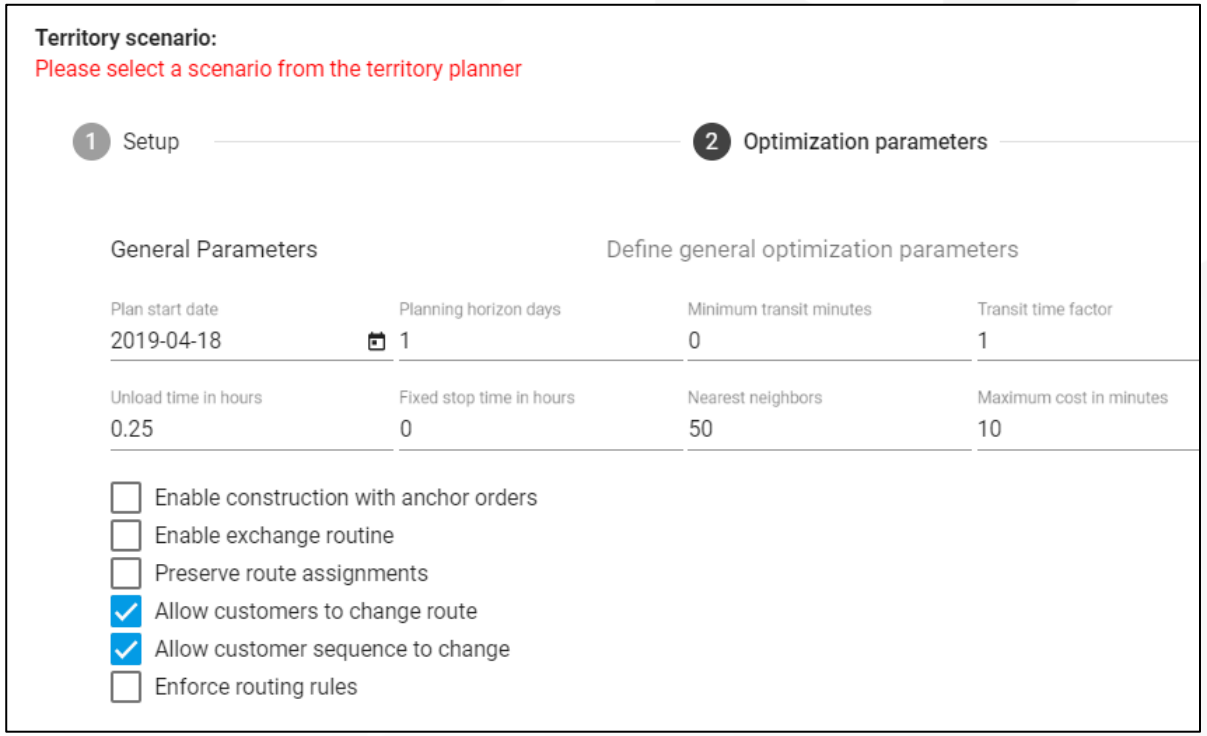
“Automated” Route Optimization

- Dynamic routes
- Master routes

True cloud routing and scheduling solution that leverage parallel computing architecture and advanced optimization algorithms.



Flexible constraints and objectives

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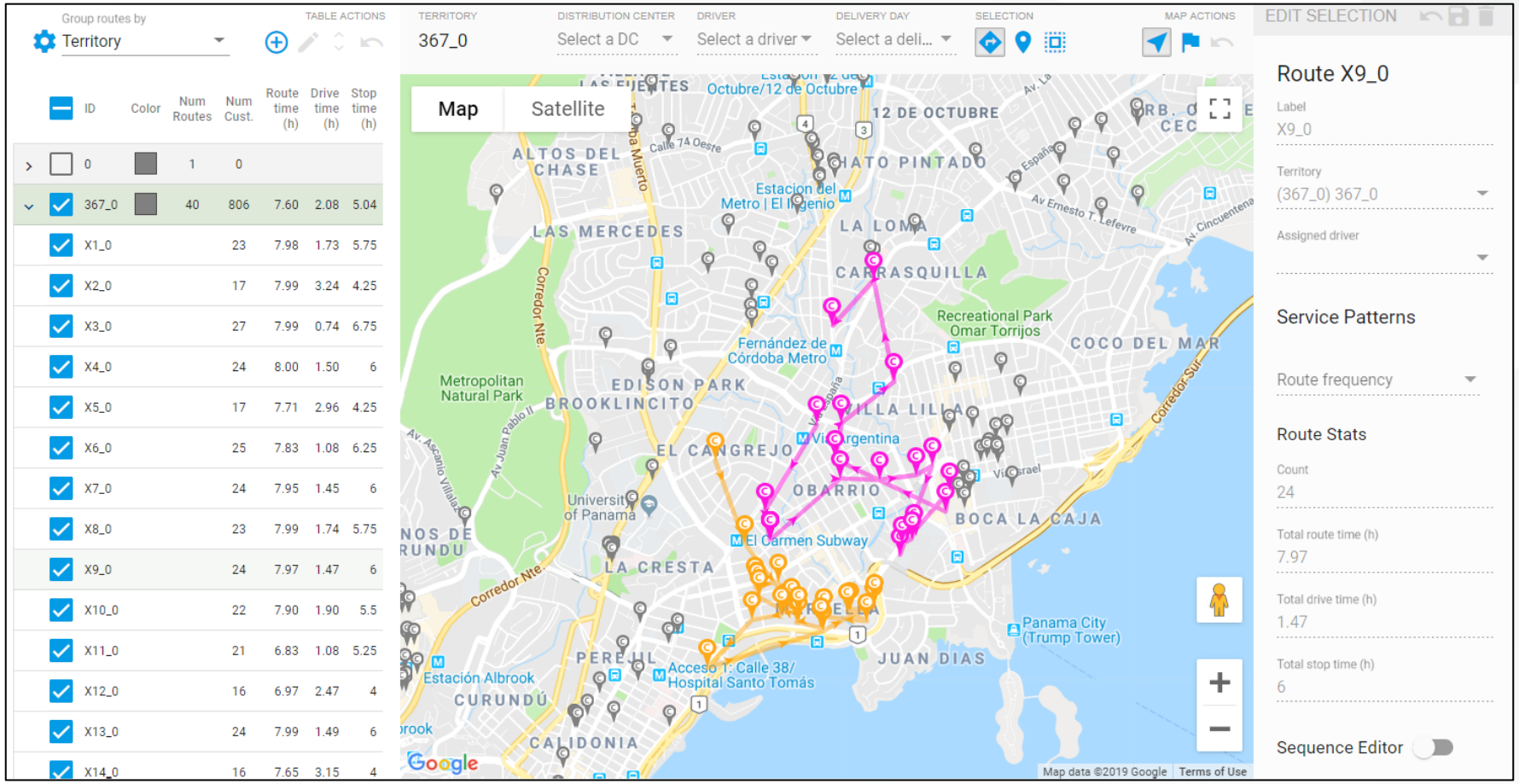
Automated Daily Route Generation



Efficient and compact routes

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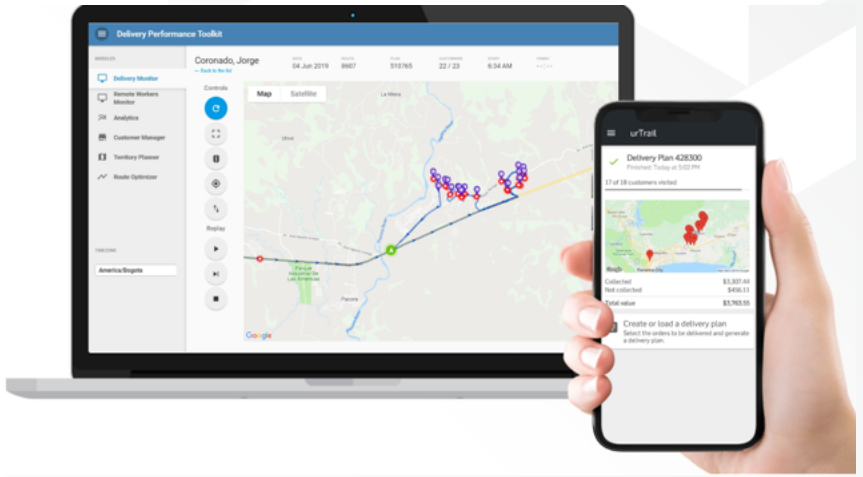
Mobile Platform

- Capture GPS trails
- Capture reasons for returns
- Capture reasons for no sales
- Provide digital information to help driver and salespeople improve effectiveness
- Provide managers with “smart” real-time visibility
- Provide alerts to drivers, salespeople, managers and customers



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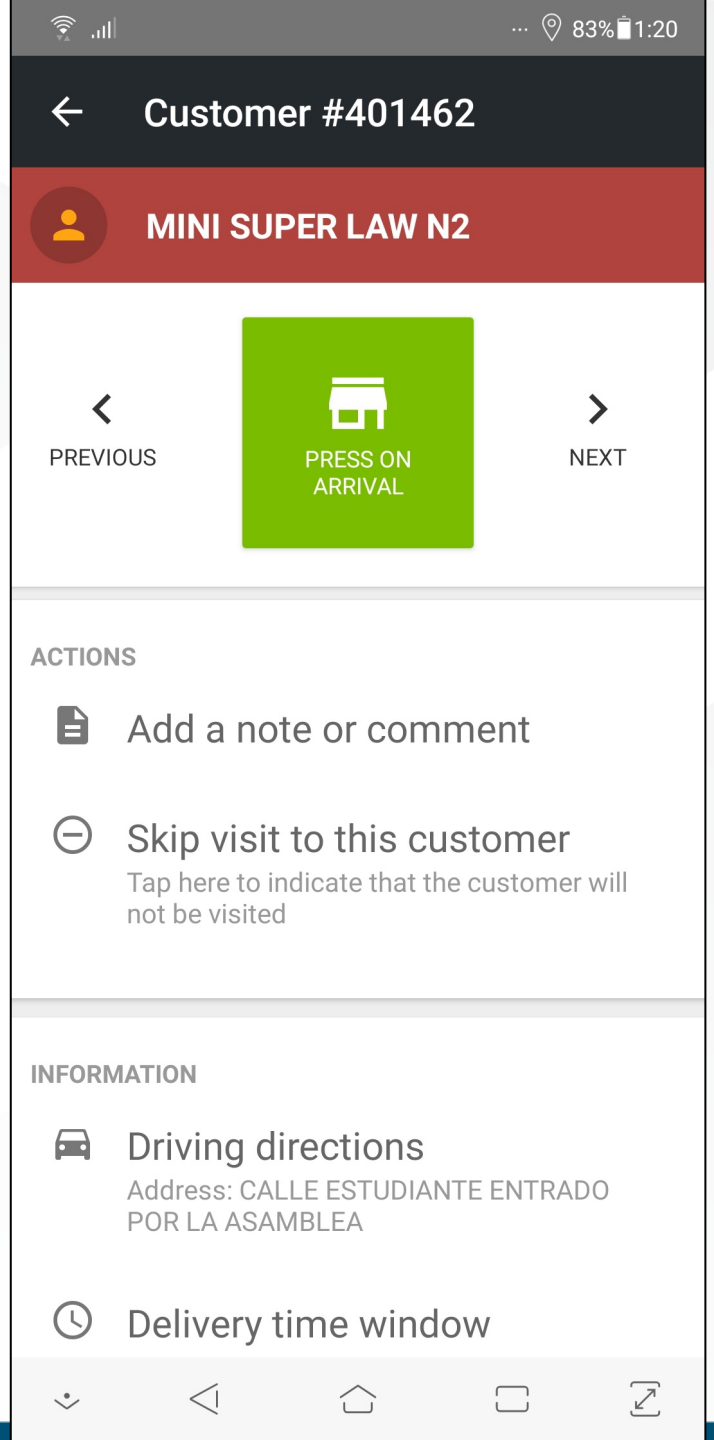
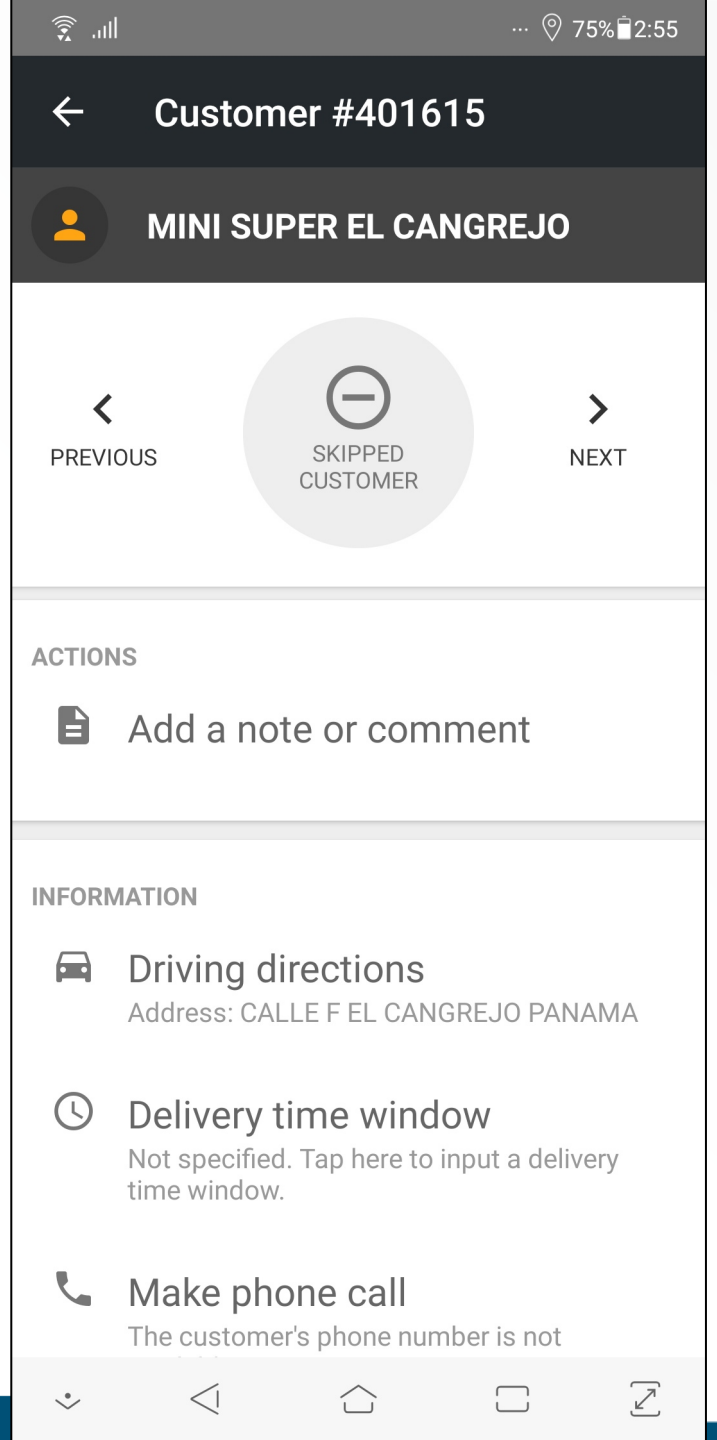
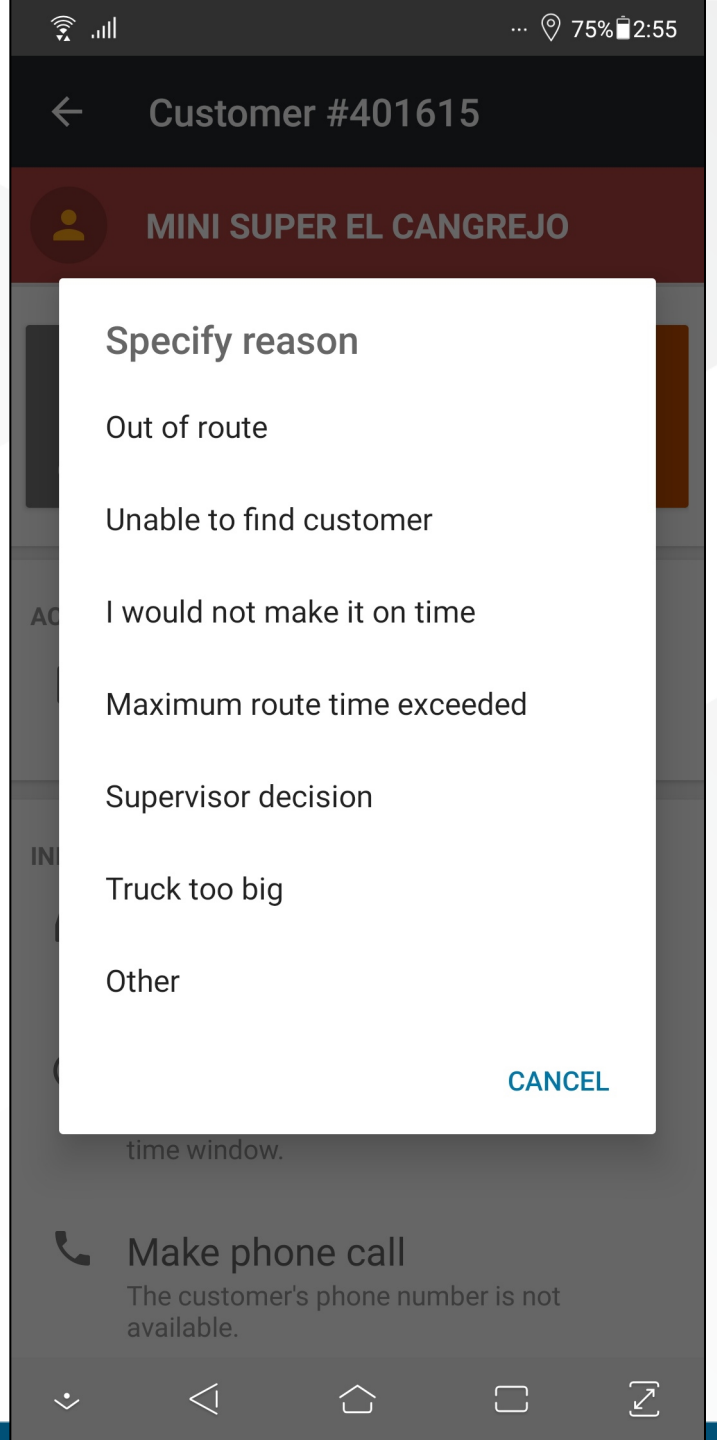
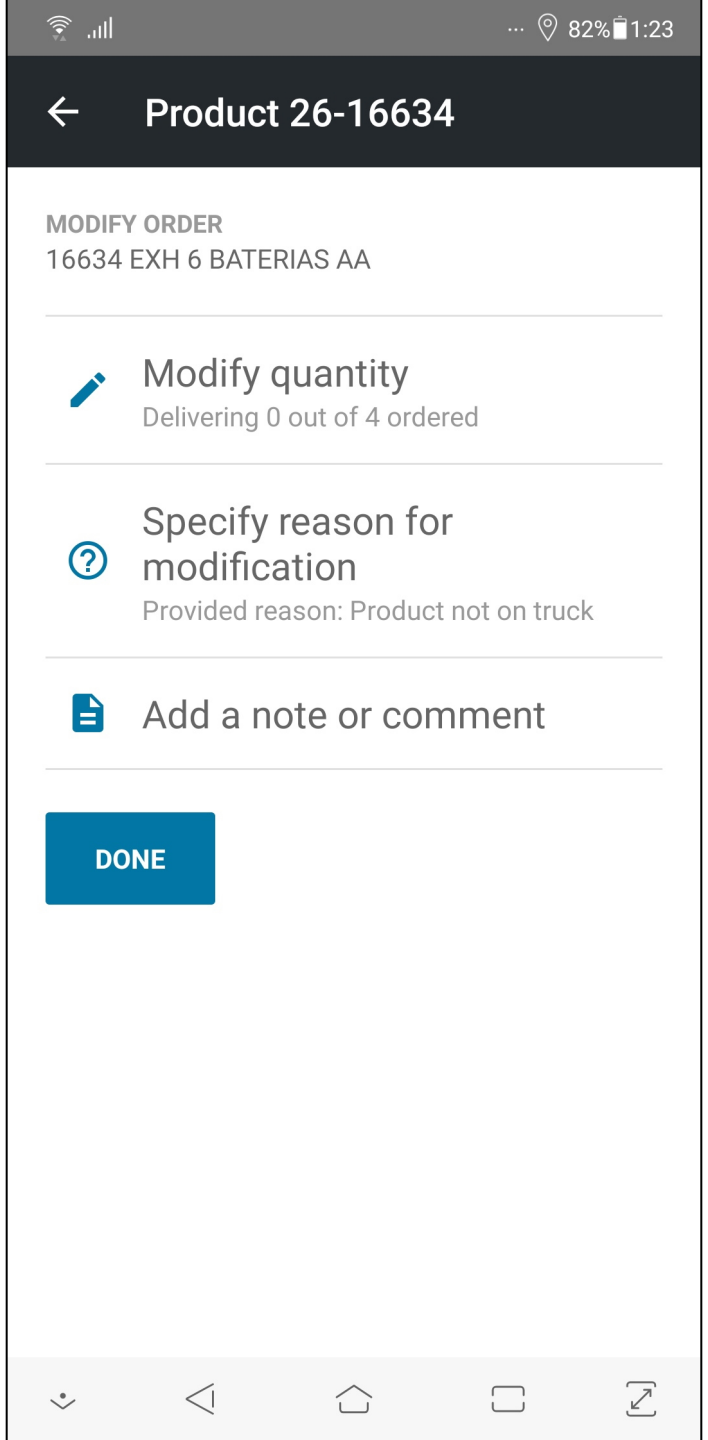
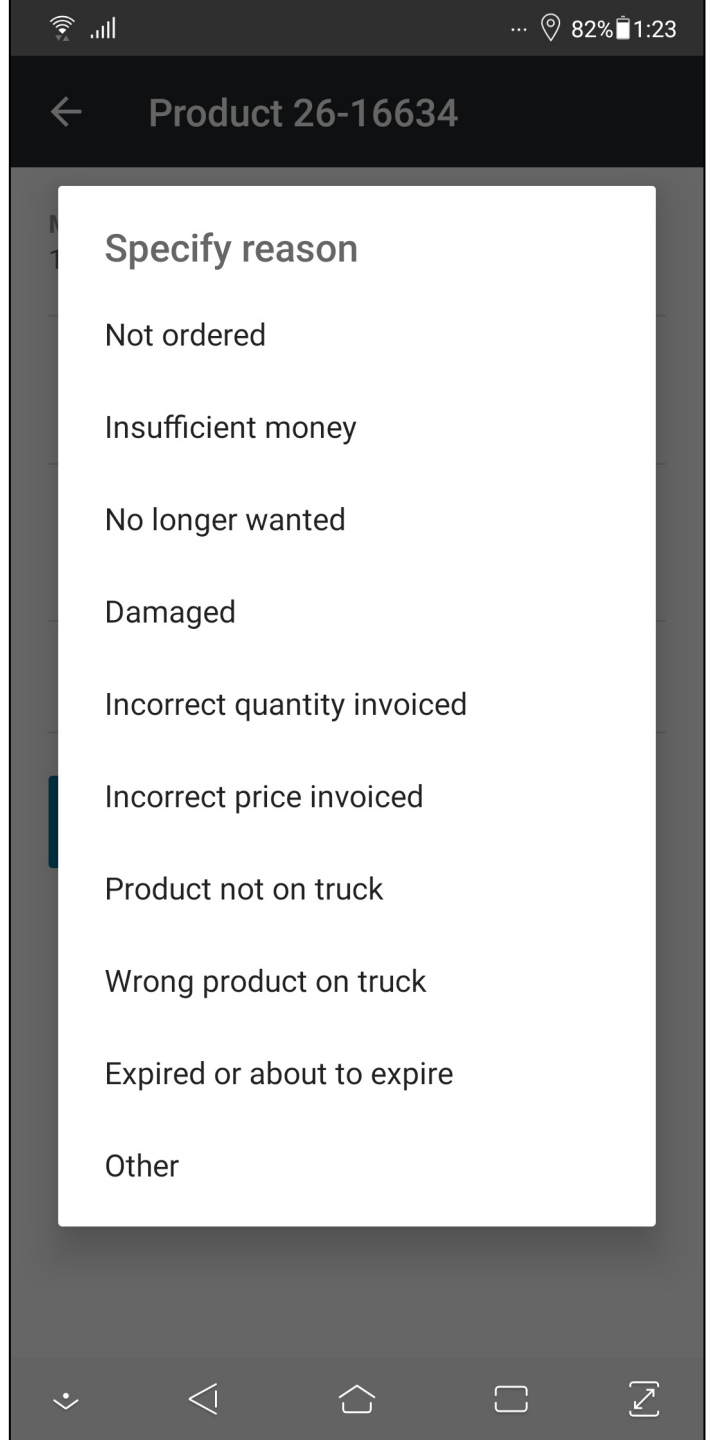
75% 2:54
Route Assistant
Ongoing sales plan
Stop
1
MINI MARKET Y FRUTERIA YESS
Address: BELLA VISTA, CALLE JOSE DE FABREGA CASA LOCAL N 3.
2
MINI SUPER EL CANGREJO
Address: CALLE F EL CANGREJO PANAMA
3
MINI SUPER EXPLORA
Address: EL CANGREJO CALLE F PANAMA
4
MINI SUPER VETERANO
Address: EL CANGREJO BETHANIA, PANAMA
5
MINI SUPER UNIVERSIDAD
Address: CALLE MANUEL ESPINOZA BATISTA AL LADO DE ARTEC EDIF.UNIVECID
6
M S Y FRUTERIA CD
Address: VIA ARGENTINA, FTE A MONOLO PANAMA

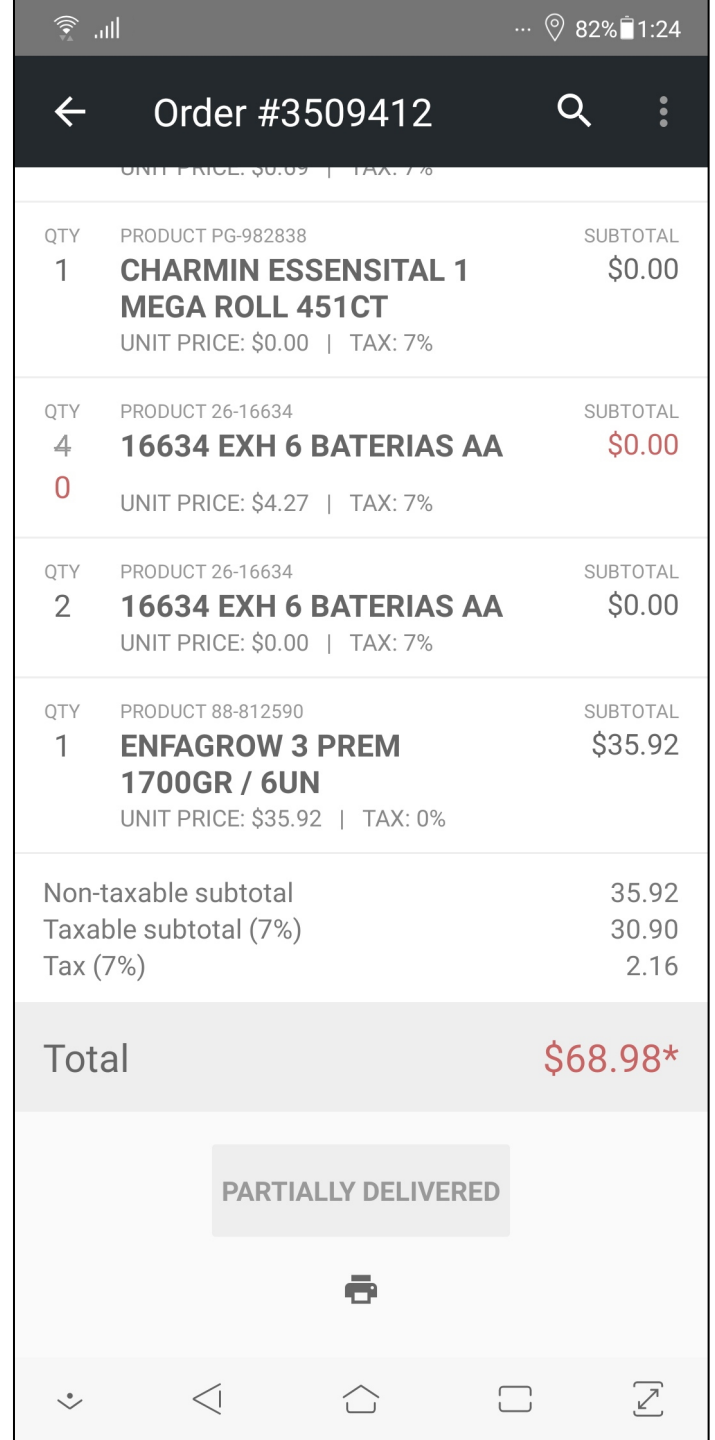

83% 1:20
Customer #401462
MINI SUPER LAW N2
PREVIOUS
PRESS ON ARRIVAL
NEXT
ACTIONS
Add a note or comment
Skip visit to this customer
Tap here to indicate that the customer will not be visited
INFORMATION
Driving directions
Address: CALLE ESTUDIANTE ENTRADO POR LA ASAMBLEA
Delivery time window


75% 2:55
Customer #401615
MINI SUPER EL CANGREJO
PREVIOUS
SKIPPED CUSTOMER
NEXT
ACTIONS
Add a note or comment
INFORMATION
Driving directions
Address: CALLE F EL CANGREJO PANAMA
Delivery time window
Not specified. Tap here to input a delivery time window.
Make phone call
The customer's phone number is not

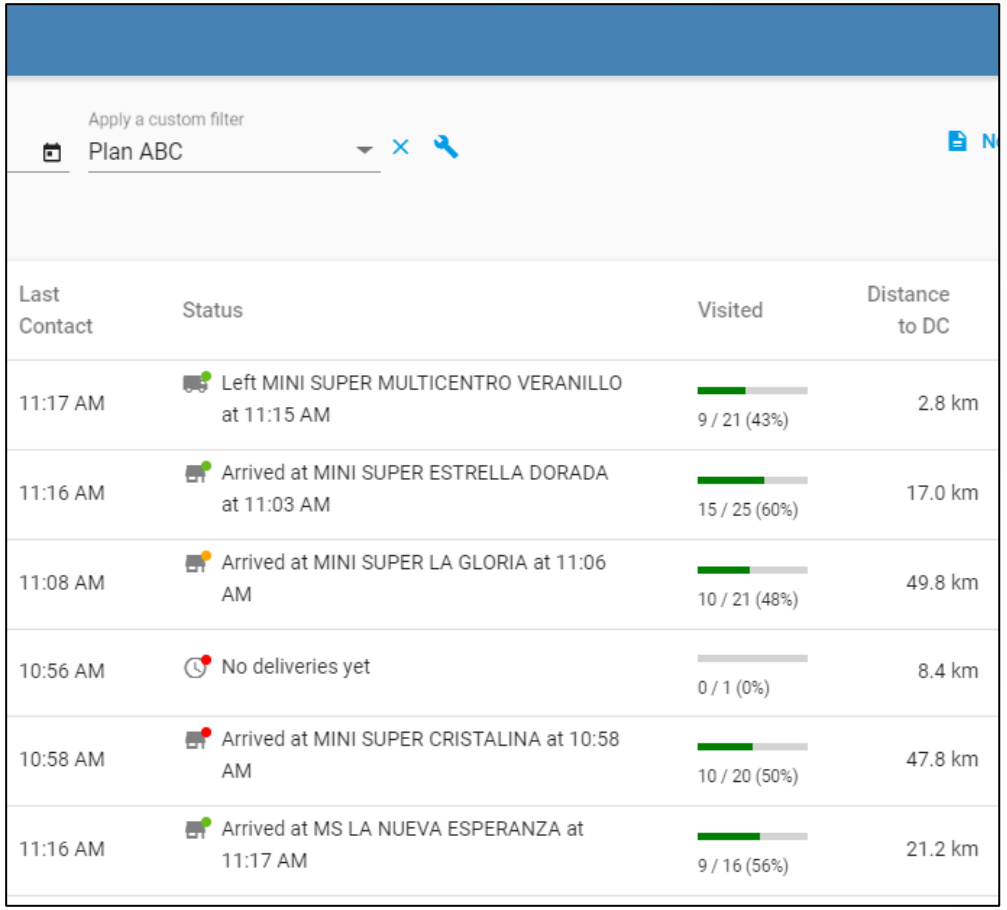

75% 2:55
Customer #401615
MINI SUPER EL CANGREJO
Specify reason
Out of route
Unable to find customer
I would not make it on time
Maximum route time exceeded
Supervisor decision
Truck too big
Other
CANCEL
time window.
Make phone call
The customer's phone number is not available.


82% 1:23
Product 26-16634
MODIFY ORDER
16634 EXH 6 BATERIAS AA
Modify quantity
Delivering 0 out of 4 ordered
Specify reason for modification
Provided reason: Product not on truck
Add a note or comment
DONE


82% 1:23
Product 26-16634
Specify reason
Not ordered
Insufficient money
No longer wanted
Damaged
Incorrect quantity invoiced
Incorrect price invoiced
Product not on truck
Wrong product on truck
Expired or about to expire
Other

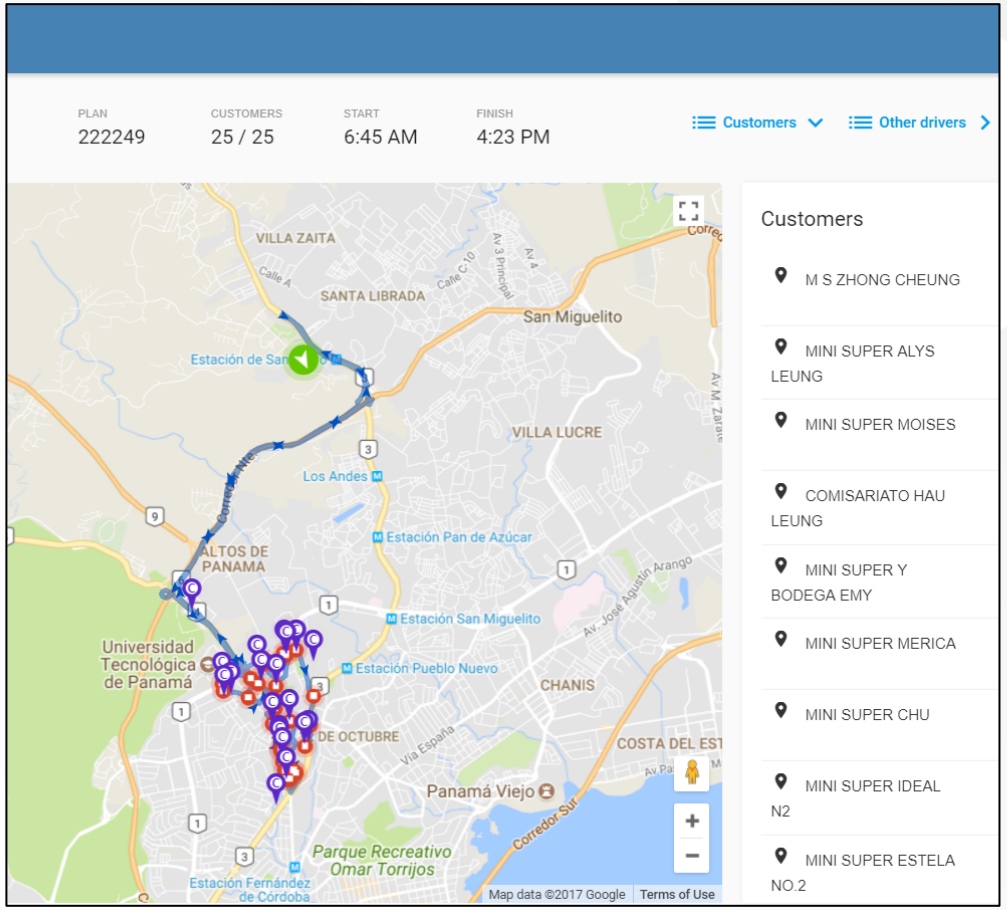

82% 1:24
Order #3509412
QTY 1
PRODUCT PG-982838
CHARMIN ESSENSITAL 1 MEGA ROLL 451CT
UNIT PRICE: $0.00 | TAX: 7%
SUBTOTAL $0.00
QTY 4 0
PRODUCT 26-16634
16634 EXH 6 BATERIAS AA
UNIT PRICE: $4.27 | TAX: 7%
SUBTOTAL $0.00
QTY 2
PRODUCT 26-16634
16634 EXH 6 BATERIAS AA
UNIT PRICE: $0.00 | TAX: 7%
SUBTOTAL $0.00
QTY 1
PRODUCT 88-812590
ENFAGROW 3 PREM 1700GR / 6UN
UNIT PRICE: $35.92 | TAX: 0%
SUBTOTAL $35.92
Non-taxable subtotal 35.92
Taxable subtotal (7%) 30.90
Tax (7%) 2.16
Total $68.98*
PARTIALLY DELIVERED

What is the role of real-time visibility?



Last Contact	Status	Visited	Distance to DC
11:17 AM	Left MINI SUPER MULTICENTRO VERANILLO at 11:15 AM	9 / 21 (43%)	2.8 km
11:16 AM	Arrived at MINI SUPER ESTRELLA DORADA at 11:03 AM	15 / 25 (60%)	17.0 km
11:08 AM	Arrived at MINI SUPER LA GLORIA at 11:06 AM	10 / 21 (48%)	49.8 km
10:56 AM	No deliveries yet	0 / 1 (0%)	8.4 km
10:58 AM	Arrived at MINI SUPER CRISTALINA at 10:58 AM	10 / 20 (50%)	47.8 km
11:16 AM	Arrived at MS LA NUEVA ESPERANZA at 11:17 AM	9 / 16 (56%)	21.2 km

Execution at a glance



Detailed map view

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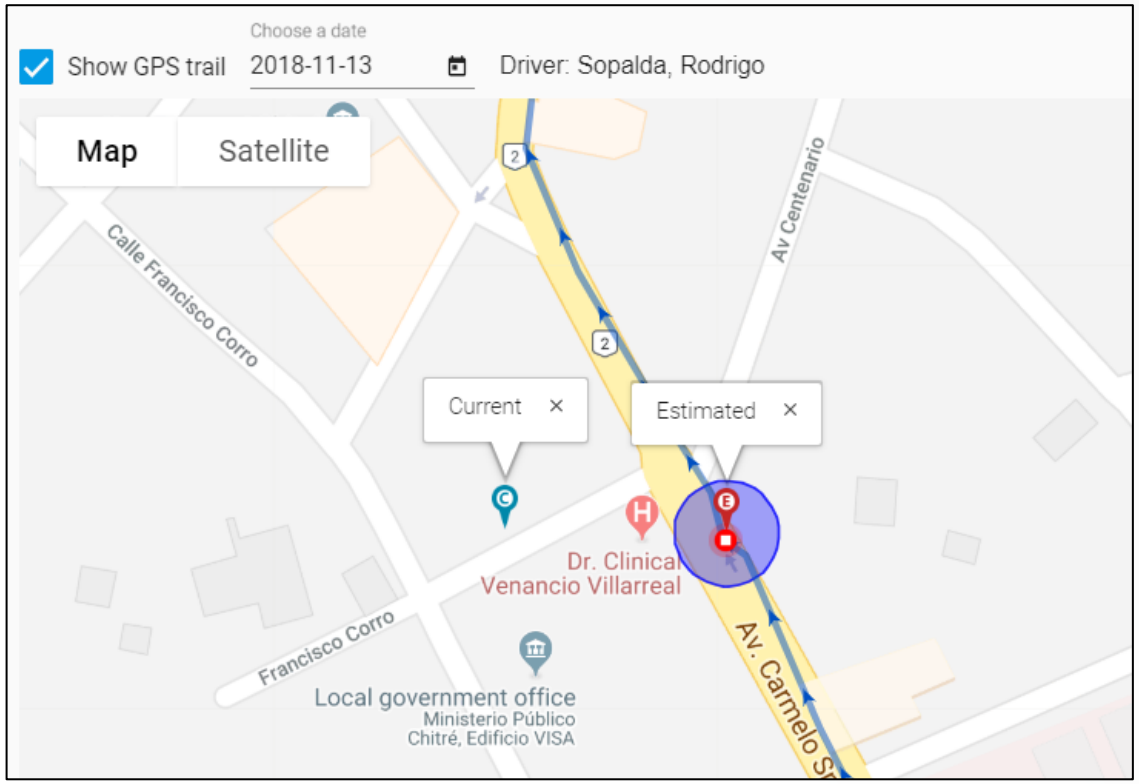
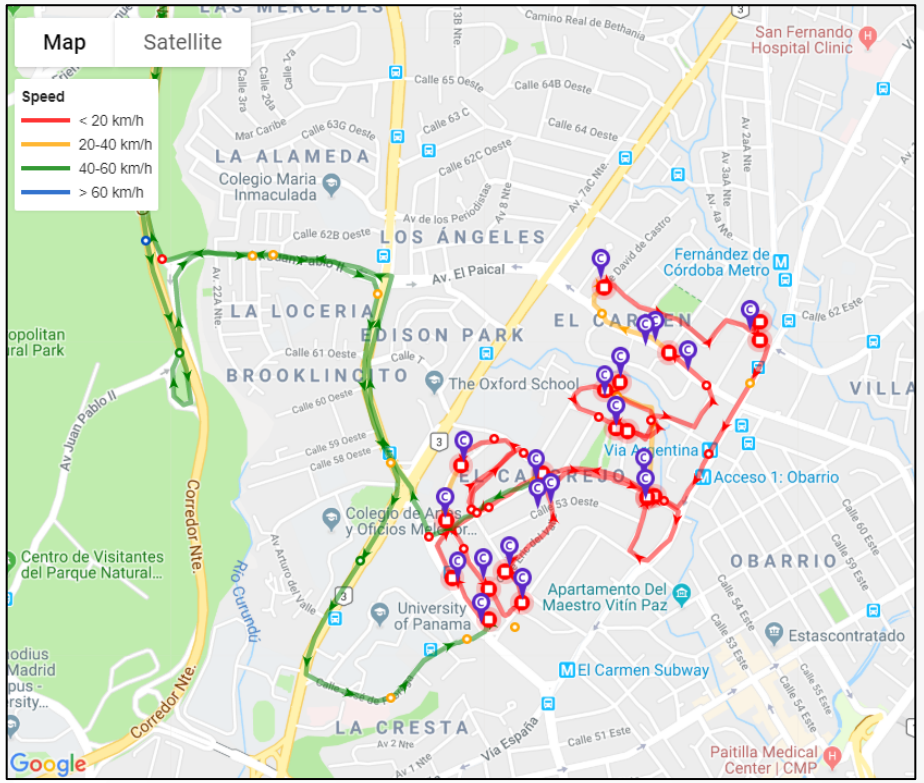
Automated data improvement



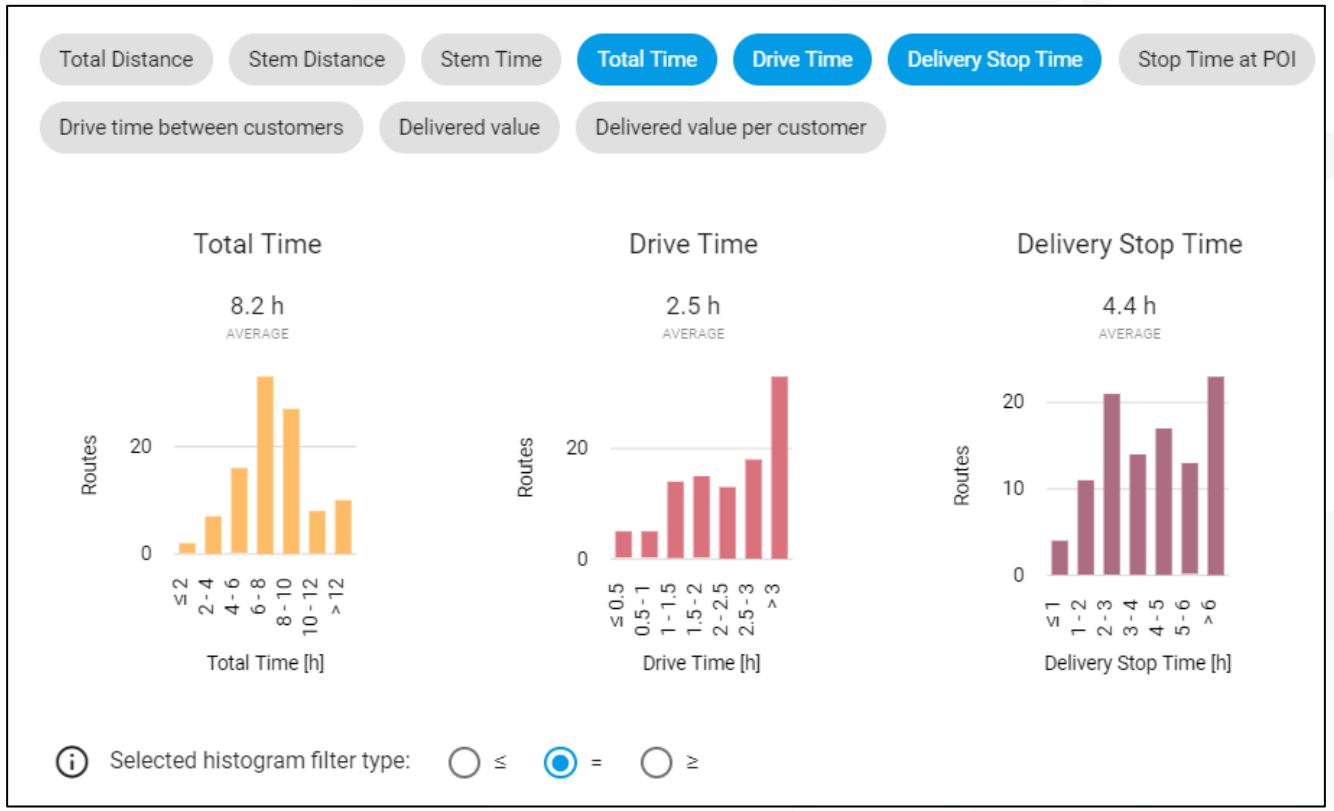


- Geocodes

- Stop times
- Drive times

Delivery Dynamics

What is the role of business analytics?



Data visualization

- Business decisions
- Business insights
- Identify where to improve delivery
- Identify how to improve delivery

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Why Delivery Dynamics?

KEY FEATURES

Tools for developing master plans that digitally maintain the key characteristics of the delivery system and guide daily route optimization.

Automated optimization of daily route plans.

Mobile applications to collect delivery data and provide real-time status.

Business intelligence regarding routes, deliveries, drivers, customer and products.

Data science for cleaning data, improving planning estimates and identify problems.

Integrated technology designed to support a continual improvement process.

BENEFITS

- ✓Better utilization of drivers and sales reps.
- ✓More driver/customer familiarity.
- ✓Improved planner productivity.
- ✓More efficient and reliable delivery plans.
- ✓Systematic planning process.
- ✓Fewer planners to maintain and train.
- ✓Provides data for master delivery plan improvements.
- ✓Enables supervisors to mitigate delivery problems.
- ✓Provides customer visibility to delivery status.
- ✓Analytical measurements of driver performance and customer profitability,
- ✓Identification of problem accounts and products.
- ✓Better data and planning estimates
- ✓Guidance for improving delivery plans
- ✓A single point of support for delivery technology
- ✓Technology components designed to work together
- ✓Seamless movement of data reduces risks

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Questions?

Delivery Dynamics